

VEHICLE SEAT ASSEMBLY

The invention relates to a seat assembly for use in a vehicle, and in particular to a seat assembly which is adaptable for use by a child. The invention finds particular  
5 benefit when employed in vehicles fitted with an airbag on the passenger side of the vehicle.

For babies and very young children, typically up to the age of 18 months, it is recommended for a child seat to be arranged in a rear-facing direction to the  
10 direction of travel. Furthermore, it is often desirable for the child seat to be located on the passenger seat of the vehicle, next to the driver, so that the driver has the child in view at all times.

Due to increasing vehicle safety standards it is becoming more common to  
15 provide an airbag device on both the passenger side of the vehicle and on the driver's side. It is recognised, however, that it is not safe to provide an airbag on the passenger side of the vehicle if a rear-facing child seat is to be mounted in the passenger seat.

20 Car dealers have developed one solution to address this incompatibility, and that is to disable permanently the passenger airbag at the time of vehicle sale if there is a likelihood that the buyer will wish to mount a child seat in the passenger seat. This solution is undesirable, however, as due to the permanent disabling of the passenger airbag it does not then facilitate use of a passenger airbag in the event  
25 that no child seat is mounted in the passenger seat and an adult passenger is carried, for example. Furthermore, over the life of a vehicle it is likely that the requirements of the owner, or owners, may change, and there may be times when there is no longer a requirement to carry child passengers. The reverse problem

also occurs if a vehicle does not have the passenger airbag disabled at the time of manufacture, but there later becomes a requirement to use a child seat in the passenger seat.

5 Another proposed solution is to provide the vehicle with a switch for allowing the user to disable or enable the airbag depending on whether a rear-facing child seat is to be used in the passenger seat. This solution is also undesirable, however, due to the risk of inadvertent disabling of the passenger airbag.

10 One other problem facing vehicle manufacturers is the adaptability of vehicles for different situations. For example, although a vehicle user may wish to seat a child in the front passenger seat on some occasions, there may often be circumstances when an adult passenger must be seated instead.

15 It is an object of the present invention to provide a seat assembly, suitable for accommodating a child, which seeks to address at least one of the aforementioned problems.

According to a first aspect of the present invention, there is provided a vehicle  
20 seat assembly comprising a passenger seat having a passenger seat member and a passenger seat back, and a child seat assembly having a child seating part, a child back rest part and having first and second alternative child seat configurations, wherein the passenger seat member is movable between a first position in which the child seat assembly is substantially hidden from view and a second position in  
25 which the child seat assembly is exposed to enable a child to be seated therein when the first child seat configuration is provided.

In one advantageous embodiment, the child seat assembly is removably mounted upon the passenger seat so that it can be removed completely from the vehicle, if desired. In this way, a seated child can be removed from the vehicle and carried conveniently simply by removing the child seat assembly from the passenger seat,  
5 but without having to remove the child from his or her seat.

In one embodiment, the child seating part is coupled to the child back rest part, for example through a hinge arrangement, to allow interchange between the first and second child seat configurations through unfolding and folding of these parts  
10 relative to one another (when unfolded the first child seat configuration is provided and when folded the second child seat configuration is provided). When the child seating part and the child seat back part are folded together, a compact and portable unit is provided for ease of carrying. When the child seating part and the child seat back part are unfolded, a seat configuration is provided for a child  
15 whether the child seat assembly is mounted within, or removed from, the passenger seat.

In an alternative embodiment, the seating and back rest parts of the child seat assembly may be integrally formed from a suitably flexible material to allow  
20 unfolding and folding between the first and second child seat configurations.

The passenger seat may include a seat base defining an internal volume within which the child seat assembly is accommodated, wherein the seat base is provided with a seat base mount and the child seat assembly is provided with at  
25 least one child seat mount for co-operation with said seat base mount to enable mounting of the child seat assembly thereon. When folded, the child seat

assembly can be hidden from view within the internal volume of the seat base by lowering the passenger seat member to rest upon the seat base.

5 In one embodiment, the child seat assembly includes first and second child seat ISOFIX mounts for co-operation with an ISOFIX-compatible support provided on the seat base (for example a rear-side bar). ISOFIX-type mounts are well known and provide a universal automotive industry standard for mounting child seats within vehicles.

10 Additionally, the child seat back part may be provided with a releasable mounting means to permit the child back rest part to be mounted upon the passenger seat (e.g. the seat base thereof) in a removable fashion.

15 If it is a requirement for larger children to be carried in child seat assembly, the passenger seat back may be provided with a movable section to define an opening for accommodating a seated child's legs and/or feet. The section of the seat back may be removable completely from the passenger seat back or may take the form of a flap section.

20 In a particularly preferred embodiment, the vehicle seat assembly includes indication means for providing an indication of whether the passenger seat member is in the first or second position. For example, the indication means may include an electrical switch arrangement.

25 The switch arrangement may be a push-type or on-off switch arrangement, wherein one switch part is mounted on a fixed part of the passenger seat and the other switch part is mounted on the movable passenger seat member.

Alternatively, the switch arrangement may take the form of a tilt-type switch arrangement.

5 In a further alternative embodiment, the switch arrangement takes the form of a latch arrangement including a first latch member which is mounted on the passenger seat member and co-operable with a second latch member, preferably mounted on a fixed part of the seat assembly. Thus, when the seat assembly adopts the first seat position to seat an adult passenger, the first latch member engages or otherwise co-operates with the second latch member, and when the  
10 first seat member is pivoted or otherwise opened such that it is inclined at an angle to the horizontal, the latch members are caused to disengage from one another. The latch means may take the form of electrical latch means, so that when the passenger seat member is moved out of a generally horizontal position, an electrical connection is broken, said electrical connection being re-established  
15 when the first seat member is lowered into the generally horizontal position causing said first and second latch members to engage.

It may be preferable for a latch arrangement to be used, as opposed to an 'on-off' switch, to ensure the switch arrangement remains latched securely when the first  
20 seat position is provided. It is a particular advantage that, when used in a vehicle provided with a passenger airbag, the indication means can be used to provide a disable signal to a vehicle airbag controller to automatically disable the passenger airbag function if a seat position is provided for seating a child. The provision of the latch means is particularly advantageous in that it prevents inadvertent  
25 disabling of the passenger airbag if an adult passenger is seated.

Preferably, the passenger seat forms a front passenger seat of the vehicle, namely that seat mounted adjacent to a vehicle driver's seat.

5 The child seat assembly preferably includes means for supporting a child's head to prevent unwanted lateral and/or angular movement thereof in the event of a side-vehicle impact. For example, said supporting means may take the form of a carry-handle. The handle may be of generally horse-shoe shape to envelope the child back rest part when in a handle-stowed position, and may be movable into a carrying position to enable convenient carrying of the child seat assembly when  
10 removed from the seat assembly.

According to a second aspect of the invention, there is provided a child seat assembly forming part of a vehicle seat assembly of the first aspect of the invention, wherein the child seat assembly is provided with a handle of the  
15 aforementioned type by which the child seat assembly may be carried.

Preferably, the handle is movable between a stowed position, which is adopted in circumstances in which the seat position is provided for a child passenger, and a carrying position which is adopted in circumstances in which the child seat  
20 assembly is removed from the seat assembly altogether to be carried.

Optionally, the handle may be coupled with a membrane which is movable with the handle so as to provide at least a partial cover for a child seated within the child seat assembly. For example, if the membrane is waterproof then a child being carried within the child seat assembly will be protected from rain.

25 The vehicle seat assembly may also include a tray mounted within the internal volume of the seat base to provide a storage volume when the child seat assembly is removed from the seat assembly. The tray may be a permanent feature of the



assembly, or may be mounted within the internal volume in such a way that it can be removed easily, if required.

5 It will be appreciated that the preferred and/or optional features of the second aspect of the invention may be incorporated alone or in appropriate combination within the first aspect of the invention also.

10 According to a third aspect of the invention, there is provided a child seat assembly for interchangeable mounting within either a vehicle seat assembly of the first aspect of the invention or within a push-chair frame, wherein the child seat assembly includes at least one ISOFIX mount for co-operation with a respective ISOFIX-compatible support provided on the push-chair frame and on the vehicle seat assembly.

15 The child seat assembly is particularly versatile and provides a convenient means of moving a child between the vehicle, a push-chair or any other suitable child-carrying apparatus.

20 According to the fourth aspect of the invention, therefore, there is provided a push-chair including a push-chair frame and a child seat assembly of the third aspect of the invention, wherein the push-chair frame includes an ISOFIX-compatible support for co-operation with an ISOFIX mount of the child seat assembly.

25 According to a fifth aspect of the present invention there is provided a vehicle seat assembly providing first and second seat positions for a passenger and including a first seat member and a seat back defining a first seat surface and a

first back rest surface, respectively, for the passenger when the first seat position is provided, and a second seat member defining a second seat surface for the passenger when in the second seat position, wherein the first seat member is movable relative to the second seat member to define a second back rest surface  
5 for the passenger when in the second seat position.

In one embodiment, the first seat member is a dual-sided seat member having a first side defining the first seat surface and an oppositely facing side defining the second back rest surface.

10 Preferably, therefore, pivot means may be provided for permitting the dual-sided seat member to pivot relative to the second seat member, into an inclined position, thus permitting the seat assembly to be moved between the first and second seat positions. The pivot means may include a hinged arrangement.

15 In an alternative embodiment, the first seat member is translatable relative to the second seat member, for example so that the first seat surface and the second back rest surface are defined by the same surface of the first seat member. It is also envisaged that the first seat member may be moved rotatably in order to  
20 change seat positions.

It is a preferred feature of the invention for the seat assembly to be provided with indication means for providing an indication of whether the seat assembly adopts the first or second seat position for the passenger.

25 Conveniently the first seat member is movable between a generally horizontal position and a generally upright position, and thus the indication means provides



an indication of whether the first seat member is generally horizontal or generally inclined to the second seat member.

5 The first seat member preferably forms a part of a front seat assembly of a vehicle (i.e. the seat assembly mounted adjacent to a driver's seat). Thus, in this embodiment, the first seat surface of the first seat member forms the seat surface that would usually be that upon which the front passenger of the vehicle is seated.

10 Alternatively, the first seat member may form part of a front seat assembly for the vehicle driver.

15 It is a particularly preferred embodiment of this aspect of the invention that the first seat position (hereinafter referred to as the 'adult seat position') is adopted by an adult passenger, and the second seat position (hereinafter referred to as the 'child seat position') is adopted by a baby or child passenger. As the first seat member defines both a seat surface for an adult passenger, and a back rest surface for a child passenger, the seat assembly may therefore be considered to be a child seat that is integral with a passenger seat of a vehicle, or in other words an "integrated child seat". The child seat position is provided when the first seat  
20 member is moved, for example pivoted or translated, out of its generally horizontal position into its generally upright position.

25 As for the first aspect of the invention, the vehicle with which the seat assembly is used may be provided with disabling means for disabling automatically a passenger airbag of the vehicle in the event that the second seat position (the child seat position) is provided for the passenger. It is a particular advantage that, when used in a vehicle provided with a passenger airbag, the indication means

can be used to provide a disable signal to a vehicle airbag controller to automatically disable the passenger airbag function if the second seat position is adopted. It is this second seat position that is particularly suitable to be taken up by a young baby or child as it defines a rear-facing seat position (i.e. a seat position facing away from the front of the vehicle) that is recommended for young children for safety reasons. This aspect of the invention therefore also permits active passenger airbags to be incorporated in vehicles in which it is desirable to carry young children or babies in a rear-facing seat position in the front passenger seat of the vehicle, as it provides a means for automatically disabling the airbag in circumstances in which a child is the passenger whilst enabling the airbag in other circumstances.

In an alternative use of the seat assembly, the first and second seat positions may be suitable for adult passengers, particularly if the seat back is movable out of a generally upright position into a reclined position in which the first back rest surface defines a support surface for the legs of a passenger in the second seat position.

For example, the seat back may be provided with additional pivot means for permitting said pivotal movement of the seat back, so that it may be reclined to permit the first back rest surface to define a leg support for a passenger when in the second seat position (i.e. a rear facing position).

Alternatively the seat back may be foldable or collapsible so as to provide a rear-facing seat position (the second seat position) for an adult as an alternative to an adult forward-facing seat position (the first seat position).

In a further preferred embodiment the second seat surface is hidden from view when the seat assembly adopts the first seat position, and may be exposed when the first seat member is moved out of its generally horizontal position into its generally upright position to define the second seat position. The second seat member conveniently forms a part of a base for the seat assembly, but  
5 alternatively may be a seat part mounted upon the seat assembly base.

In a further preferred embodiment the seat assembly is provided with a harness or restraining means for harnessing the passenger in the second seat position, and  
10 more preferably the harness means are mounted upon the first seat member. The seat assembly is also preferably provided with a harness or restraining means for a passenger seated in the first seat position, such as a conventional vehicle seat belt arrangement.

15 For example, the harness means for the passenger in the second seat position may include at least a first harness for harnessing in a cross-body configuration and a second harness for harnessing in a head-to-waist configuration, preferably a V-shaped head-to-waist configuration. Alternatively, the harness means may include a harness for harnessing in a head-to-waist configuration only. Other harness  
20 configurations are also envisaged.

The seat assembly is preferably provided with adjustment means for adjusting the angle of inclination of at least one of the back rest surfaces so as to accommodate the differing comfort requirements of passengers.

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As for the first aspect of the invention, the indication means preferably includes a switch arrangement, such as a 'push-to-make' type switch or a tilt-type switch,

having first and second switch states, a first switch state corresponding to the first seat member being in its first position and a second switch state corresponding to the first seat member being in its second position.

5 Alternatively, and preferably, the switch arrangement takes the form of a latch arrangement including a first latch member mounted on the dual-sided seat member and co-operable with a second latch member, preferably mounted on a fixed part of the seat assembly such as the second seat member. Thus, when the seat assembly adopts the first seat position, the latch member of the first seat  
10 member engages or otherwise co-operates with the latch member on the second seat member, and when the first seat member is pivoted or otherwise moved relative to the second seat member such that it is inclined at an angle to the second seat member, the latch members are caused to disengage from one another.

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Preferably, the latch means take the form of electrical latch means, so that when the first seat member is moved relative to the second seat member, out of its generally horizontal position, an electrical connection is broken. The electrical connection is re-established when the first seat member is lowered into its  
20 generally horizontal position, causing the first and second latch members to engage.

It is preferable for a latch arrangement to be used, as opposed to an 'on-off' switch, to ensure the switch arrangement remains latched securely when the first  
25 seat position is provided, so as to prevent inadvertent disabling of the passenger airbag if an adult passenger is seated.

According to a sixth aspect of the invention, there is provided a vehicle having a front passenger seat assembly in accordance with the first or fifth aspects of the invention, indication means of the aforementioned type and an airbag provided on the passenger side of the vehicle, the vehicle further comprising means for  
5 disabling automatically the passenger airbag in the event that the indication means provides an indication that a seat position is provided for seating a child.

In a vehicle having these features, there is no need for the airbag facility to be disabled by other means if a child needs to be seated in the front passenger seat of  
10 the vehicle.

The present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

15 Figure 1 is a perspective view of a seat assembly of a first embodiment of the invention, including an integrated child seat, with the child seat position adopted,

Figure 2 is a perspective view of a part of the seat assembly in Figure 1,

20 Figure 3 is a front view of a back rest of the seat assembly part in Figure 2 to illustrate a harness arrangement,

Figure 4 is an enlarged view of a part of the harness arrangement shown in Figure 3,  
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Figure 5 is an enlarged view of latch means of the seat assembly in Figure 1,

Figure 6 is a schematic illustration of the control system for an airbag for use in a vehicle provided with the seat assembly of Figures 1 to 5,

5 Figure 7 is a side view of a part of the seat assembly in Figure 1, to illustrate a child in the child seat position,

Figure 8 is a top view of a part of the seat assembly in Figure 7 to illustrate a head rest of the seat assembly in further detail.

10 Figure 9 is a perspective view of a seat assembly of an alternative embodiment when an adult seat position is provided,

Figure 10 is a perspective view of the seat assembly in Figure 9 when in an alternative position in which a child seat thereof is made accessible for seating a  
15 child,

Figure 11 is a perspective view of a part of the seat assembly in Figures 9 and 10, from a reverse angle and with the seat back removed, to illustrate more clearly the mounting of the removable child seat upon the seat assembly,

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Figure 12 is a perspective view of the removable child seat in Figures 10 and 11 with a carry handle thereof in a stowed position which is adopted when the child seat is mounted within the seat assembly (i.e. as in Figure 10),

25 Figure 13 is a perspective view of the removable child seat in Figure 12 with the carry handle in a carrying position which is adopted when the child seat is removed from the seat assembly altogether, and



Figure 14 shows the removable child seat in Figures 12 and 13 when adapted for mounting within a child's push-chair.

5 Figures 1 and 2 show a vehicle seat assembly, referred to generally as 10, which incorporates both a passenger seat and an integrated child seat. It is a function of the seat assembly to provide two different seating configurations for passengers, one in which an adult passenger is seated so as to face in a forwards direction (i.e. towards the front of the vehicle) and one in which a child passenger is  
10 accommodated to face in a reverse direction (i.e. towards the rear of the vehicle). In other words, a first seating position is provided for an adult passenger facing in a forwards direction and a second seating position is provided for a child passenger facing in a rearwards direction.

15 The seat assembly 10 includes a seat back 12 defining a back rest surface 14 for an adult passenger and having, at an upper end thereof, a head rest 16 for the passenger's head. At the lower end of the seat back 12, a seat member or base 18 is provided having a cushioned region to define a seat surface 20 enclosed within a surrounding perimeter region 22. The seat base 18 is movable within guide  
20 tracks 24 that are mounted on the floor of the vehicle so as to permit movement of the complete seat assembly 10 relative to the vehicle floor in forward and rearward directions, as required by the passenger.

The seat assembly 10 includes an additional seat member 26, commonly referred  
25 to as a 'squab', which, in the embodiment of Figure 1, takes the form of a dual-sided or 'reversible' seat member having a first upper surface 28, defined by one side of the seat member 26, and a second lower surface 30, defined by an

oppositely facing side of the seat member 26. The upper surface 28 of the dual-sided seat member 26 is fully cushioned and the lower surface 30 includes a perimeter region 32 (visible only in Figure 2) partially surrounding a cushioned inner area. For the purpose of this document the seat member identified as item  
5 26 will also be referred to as the 'first seat member' and the seat member or base identified as item 18 will be referred to as the 'second seat member'.

Suitable pivot means, referred to generally as 34, are provided, as described further below, to permit the dual-sided seat member 26 to be moved between the  
10 position shown in Figure 1 (a "second" position), in which it is generally upright, or inclined, relative to the seat base 18, and an alternative position (a "first" position), which is not illustrated in Figure 1, in which the dual-sided seat member 26 is generally horizontal and rests upon or is supported by the seat base 18. When the dual-sided seat member 26 is in the horizontal position (the first  
15 position), the upper surface 28 of the dual-sided seat member 26 defines a cushioned seating surface for the passenger. Although not readily apparent from the illustration of Figure 1, from the foregoing description of the horizontal position of the dual-sided seat member 26 it will be appreciated why it is appropriate to refer to surfaces 28 and 30 as 'upper' and 'lower' surfaces  
20 respectively.

For the purpose of this specification, reference to a seat member being "generally upright" shall be taken to mean that the seat back 12 is inclined at a suitable angle suitable to define a comfortable back rest surface 14 for an adult or child  
25 passenger. Furthermore, it is usual for the driver or passenger seat base in a vehicle to be slightly inclined to the horizontal for comfort reasons, and reference to the seat member 26 being "generally horizontal" shall be taken to include such

slightly inclined seat positions that are nonetheless substantially horizontally aligned with the vehicle floor.

When the dual-sided seat member 26 is generally upright and inclined at an angle  
5 to the seat base 18 (as shown in Figure 1), the lower surface 30 of the dual-sided  
seat member 26 is facing the back rest surface 14 of the seat back 12. In this  
position the lower surface 30 defines an alternative, cushioned back rest surface  
for an alternative, second seat position for a child passenger seated on the  
cushioned surface 20 of the seat base 18. In this second seat position, the child  
10 faces away from the direction of travel so as to provide a rear-facing seat  
position, with the upper surface 28 of the dual-sided seat member 26 facing in the  
direction of travel.

When the dual-sided seat member 26 is lowered into its generally horizontal  
15 position, the perimeter region 32 of the lower surface 30 is supported upon the  
seat base 18 so that at least the cushioned region of the seat base, defining the  
seat surface 20, is effectively hidden from view. When the seat assembly adopts  
this position, it is the upper surface 28 of the dual-sided seat member 26 that  
defines a cushioned seat surface for an adult passenger. In this seat position it  
20 will be appreciated that the adult faces in the direction of travel of the vehicle,  
providing a forward-facing position as in a conventional front passenger seat.

The seat assembly of the present invention therefore offers two seat positions; a  
first position (referred to as the “adult seat position”) in which the dual-sided seat  
25 member 26 defines a seat surface 28 for an adult passenger, and a second position  
(referred to as the “child seat position”) in which the dual-sided seat member 26

defines a back rest surface 30 for a child passenger and the seat base 18 defines a seat surface 20 for the child.

5 The means by which the dual-sided seat member 26 pivots relative to the lower seat base 18 to move between the adult and child seat positions is most clearly illustrated in Figure 2. The pivot means includes first and second identical hinge arrangements 34 of generally known type provided on respective front corners of the seat base perimeter region 22 (i.e. the rearward corners in the orientation shown). The hinge arrangements 34 couple the dual-sided seat member 26 and  
10 the seat base 18 together so as to permit hinged or pivotal movement of the dual-sided seat member 26 relative to the base 18 between its inclined, upright position (as in Figure 1) and its generally horizontal position.

As in conventional seat assemblies for vehicles, the seat back 12 is provided with  
15 an adjustment means 36, in the form of a so-called “recline dial”, for permitting the angle of inclination of the seat back 12 relative to the seat base 18 to be adjusted. Typically, such adjustment means permits the seat back 12 to be moved between a first position in which it is substantially vertically inclined to the seat base 18 and either a fully-reclined position, in which the seat back 12 is folded  
20 rearwards, or a folded-forwards position in which the seat back 12 is folded fully forwards to rest against the seat base 18.

Referring to Figures 3 and 4, the dual-sided seat member 26 is also provided with restraining or harness means in the form of first and second harness straps 38, 40  
25 to ensure the child passenger is safely restrained when seated in the child seat position. The first harness strap 38 is generally of a cross-body type and the second harness strap 40 is generally of a head-to-waist type, arranged in a

generally V-like configuration. The second strap 40 passes through a central loop 42 through which the cross-body strap 38 also passes. Each end of the second strap 40 terminates in a clip or male fastener part 43 (only one of which is shown in Figure 4) which is detachably connectable with a female fastener part 44  
5 securely fixed to the perimeter region 32 of the dual-sided seat member 26.

Harness means of the aforementioned type are generally known in the vehicle seat restraining systems, and the method by which the fastener parts 43, 44 detach and connect would be familiar to a person skilled in this technology field.

10 The seat assembly is also provided with restraining or harness means (not shown) for the adult passenger when in the adult seat position. Typically the adult harness means may take the form of a conventional vehicle seat belt apparatus, as is commonly used.

15 Referring to Figure 5, the dual-sided seat member 26 and the seat base 18 are provided with co-operable parts of a switch arrangement in the form of latch indication means (identified generally as 46 in Figure 2) for providing an indication of whether the dual-sided seat member 26 is in its raised, generally upright, inclined position or its lowered, horizontal position. In Figure 5, the seat  
20 assembly adopts the adult seat position with the dual-sided seat member 26 substantially horizontal. A first latch member 48, in the form of a projection, extends downwardly from the lower surface 30 of the dual-sided seat member 26 to engage or otherwise co-operate securely with a second latch member 50 provided on the seat base 18 (not shown in Figure 5). Also shown in Figure 5 is  
25 similar adjustment means to the recline dial 36 of the seat back 12, in the form of a second recline dial 37, for permitting the angle of inclination of the dual-sided seat member 26 relative to the seat base 18 to be adjusted.

The first and second latch members 48, 50 are electrically co-operable with one another. When the first and second latch members 48, 50 are engaged with one another in the adult seat position, an electrical connection is made to define a first  
5 switch state. The electrical connection between the first and second latch members 48, 50 is broken (a second switch state) when the dual-sided seat member 26 is raised out of the horizontal position to define the child seat position. As illustrated in Figure 6, upon breaking the electrical connection of the latch means 46 an indication signal is provided to an airbag control system or  
10 control unit 52 to indicate that the dual-sided seat member 26 is raised and, hence, the child seat position of the assembly has been taken up. In such circumstances, the control system 52 provides a control signal 54 to disable a passenger airbag 56 of the vehicle. A signal 58 may also be provided from the passenger airbag 56 to the airbag control system 52, for example to inform the  
15 airbag control system 52 of airbag status.

Reconnection between the first and second latch members 48, 50 is established upon the dual-sided seat member 26 being lowered into the horizontal position (i.e. the adult seat position) and the airbag control system 52 provides a control  
20 signal 54 to enable functioning of the passenger airbag 56.

It is one benefit of the present invention, therefore, that an automatic means 46, 52, 54 is provided for disabling the passenger airbag 56 in the event that the child seat position is adopted, said means also being configured to automatically enable  
25 the passenger airbag 56 in the event that the adult seat position is adopted.



As an alternative to providing latching indication means, a less complex switch arrangement may be provided, for example an 'on/off' switch or a 'push-to-make' type switch. Alternatively, a more sophisticated tilt-type switch mechanism may be provided, whereby the generation of the passenger airbag disable signal 54 is initiated only in circumstances in which the seat member 26 is inclined relative to the seat base 18 beyond a certain amount. For a tilt-type switch embodiment, the angle of inclination of the seat member 26 at which the disable signal 54 is initiated may be adjustable.

Referring to Figure 7, it is another feature of the invention that both the cushioned region of the seat base 18 defining the seat surface 20 for the child seat position and the cushioned region of the dual-sided member 26 defining the back rest surface 30 for the child seat position are formed from polystyrene balls, which, when a child 27 is seated, mould to the shape of the child's body to provide comfortable, cushioned back rest and seat surfaces 30, 20 for the child's body. This also is of benefit in reducing the load applied to the occupant during impact.

As shown in Figure 8, which is a top view of a child's head 60 with the seat assembly 10 in the child seat position, a head end 26a of the dual-sided seat member 26 is generally cupped in shape so as to provide a means of support for the child's head 60 in rolling, side-to-side movement, as indicated by arrow 62. It will be appreciated that when the dual-sided seat member 26 is lowered into the horizontal position (to define the adult seat position), ears 26b of the head end 26a extend generally downwards and may be accommodated within a slight clearance space above the seat surface 20 of the seat base 18.

Typically, the dual-sided seat member 26, or squab, is an injection moulded component, suitably shaped to co-operate with the seat base 18 when in its first, generally horizontal position to define the first (adult) seat position of the assembly.

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In a second, alternative embodiment to that described previously, the seat assembly 10 may be adapted to provide first and second adult seat positions, one of which is forward facing (as for a conventional passenger front seat) and one of which is rearward facing. In one embodiment of a seat assembly offering two  
10 adult seat positions, it is necessary for the seat back 12 of Figure 1 to be reclined into a fully horizontal position, or below-horizontal position, so that the seat back surface 14 provides a leg support surface for the adult passenger when the rear-facing seat position of the assembly is adopted. Thus, when the dual-sided seat member 26 is moved into its inclined, generally upright position, the seat back 12  
15 can be reclined to enable the passenger to take up a seated position with his or her legs supported by the surface 14.

In a third alternative embodiment, again for providing two adult seat positions, the dual-sided seat member 26 may itself be formed from two hinged seat parts.  
20 When the dual-sided seat member 26 is in its generally horizontal position, the two hinged seat parts are aligned together, in a face-to-face configuration, and when the dual-sided seat member 26 is raised into the generally upright position, one of the hinged seat parts is 'unfolded' relative to the other. This extends the length of the seat member 26 shown in Figure 1, thus providing an elongated  
25 back rest surface 30 for the passenger.

The seat assembly of the second and third embodiments of the invention may find particular use in vehicles intended for carrying several passengers, or in motor homes or the like. For example, it may be desirable to provide a row of seat assemblies of the aforementioned type, each of which is capable of being moved  
5 independently between its forward facing and rear facing adult seat positions. In motor-homes it may be useful to move the seat assembly between its forward and rear facing adult seat positions depending on whether the motor home is travelling or temporarily static. It will therefore be appreciated that the seat assembly, although providing particular advantages when utilised as an integrated  
10 child seat, may also be configured to provide two different adult seat positions.

Although the seat member 26 in the foregoing description is pivotal with respect to the seat base 18 to enable switching between the first and second seat positions, it is also envisaged that the pivot means 34 may be replaced by means  
15 for permitting translatory movement of the seat member 26 relative to the seat base 18. In this embodiment, there is no longer a need to provide a dual-sided seat member, as the same surface of the seat member (i.e. the upper surface 28, as shown in Figure 1) defines the seating surface for the passenger in both the first and second seat positions.

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In a further alternative variation, means for enabling translatory and rotatable movement of the seat base 26 relative to the seat base 18 may be provided to allow the seat member 26 to be moved to define the two different seat positions of the assembly.

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Figure 9 shows an alternative vehicle seat assembly 110 in accordance with another aspect of the invention. The seat assembly 110 includes an adult

passenger seat, with similar parts to those of the previous embodiments denoted with like reference numerals. The passenger seat therefore includes a seat back 12 defining a back rest surface 14 for an adult passenger, a head rest 16 for the passenger's head, a seat base 18 supporting a seat member or squab 26 which  
5 defines a seating surface 28 for an adult passenger and guide tracks 24 mounted on the floor of the vehicle so as to permit forwards and rearwards movement of the complete seat assembly 110.

As can be seen more clearly in Figure 10, in this embodiment the seat base 18  
10 defines an internal seat base volume 70 within which a separable and removable removable child seat assembly 72 is mounted. A front edge of the seat member 26 is hingedly mounted to the seat base 18 by a suitable hinge arrangement (not shown) so as to permit hinged movement of the seat member 26 between first and second positions, as described previously. In the first position, the seat member  
15 26 rests generally horizontally on the seat base 18 to define a 'conventional' seat position for a passenger (as shown in Figure 9). In this position the internal volume 70 of the seat base 18 is enclosed and the child seat assembly 72 is hidden from view. In the second position, the seat member 26 is raised into an inclined or generally upright position (as shown in Figure 10) to open the internal  
20 volume 70, thus making the child seat 72 accessible.

Referring also to Figure 11, the child seat 72 includes a seating part or seating portion 74, and a back rest part or back rest portion, 76 which are foldable relative to one another to provide two different child seat configurations; a folded  
25 configuration (as shown in Figure 11) in which the child seat 72 can be accommodated within the enclosed volume 70 of the seat base 18 and an unfolded configuration (as shown in Figure 10) in which the child seat 72

provides a suitable seating position for a child. It will be appreciated that, due to the orientation of the view of the unfolded child seat 72 in Figure 10, only the seating part 74 is visible, whereas in the folded configuration of Figure 11 only the reverse side of the seat back part 76 is visible.

5

The seating and back rest parts 74, 76 of the child seat 72 are formed as separate parts in a hinged arrangement. In the folded configuration, the seating part 74 and the back rest part 76 are folded into contact with one another to form a relatively compact unit which can be accommodated within the internal seat base volume 70 when the passenger seat member 26 rests upon the seat base 18. In a second configuration, the back rest part 76 and the seating part 74 are unfolded to provide a suitable seating position for a child. Figures 12 and 13 also show the child seat 72 in the unfolded configuration.

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From the foregoing description it will be appreciated that the seat assembly of this embodiment of the invention also provides two different seating positions. In an adult seat position, the seat member 26 defines a seating surface 28 for an adult passenger facing forwards in the vehicle. In a child seat position, the seat member 26 is opened to allow the child seat 72 to be unfolded to define a seating position for a child passenger facing rearwards in the vehicle. It will be appreciated that, when in the adult seat position, the child seat 72 is substantially hidden from view by virtue of the seat member 26 enclosing the internal seat base volume 70.

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The child seat 72 is mounted within the seat base 18 by means of an ISOFIX compliant mounting arrangement which would be well known to a person skilled in this art. The ISOFIX child seat system is an automotive industry standard

proposed by the United Nation Economic Commissions for Europe. The ISOFIX mounting arrangement includes a support in the form of a rear-side support bar 78 which extends laterally across the rear side of the seat base 18. First and second laterally spaced seat mounts 80 are provided at the rear edge of the child seating part 74, with the mounts 80 being arranged for detached coupling to the rear-side support bar 78. A second support in the form of a front-side support bar 82 (not visible in Figure 10) extends laterally across the front side of the seat base 18.

The child seat 72 is provided with a releasable catch mechanism (not shown) which co-operates with the front-side support bar 82. For example, a lower portion of the reverse side of the child seat back rest part 76 (i.e. the side of the back rest part 76 which does not define the back rest surface) may be provided with at least one spring-loaded claw which co-operates with the front-side support bar 82 of the seat base 18 in a releasable fashion. The provision of a releasable claw is generally known in ISOFIX-type mechanisms and so would be familiar to those skilled in the art. By pushing the claw onto the front-side support bar 82, the mouth of the claw is forced opened, against the spring force, until the support bar 82 is received within the claw mount. The spring force causes the mouth to close around the support bar 82 so as to latch the child seat 72 securely to the seat base 18. A release lever (also not shown) is provided which connects with the claw through a linkage, for example. By pulling on the release lever, the mouth of the claw is caused to open, against the spring force, allowing the child seat 72 to be moved away from the front-side support bar 82. The child seat 72 is therefore removed from the seat base volume 70 by detaching the mounts 80 from the rear-side support bar 78 and releasing the claw from the front-side support bar 82.



The construction of the child seat 72 can be seen more clearly in Figures 12 and 13. The child seating part 74 and the back rest part 76 are coupled together by means of a child seat hinge arrangement (not shown), typically in the form of a conventional hinged mount, so as to permit the child seat 72 to be moved conveniently between its folded and unfolded states. The child seat is also provided with a pivotally mounted handle 84, of generally horseshoe shape, which fits around the perimeter of the back rest part 76 of the seat 72. The handle 84 is pivotally mounted to the child seat 72 by means of first and second pivot mounts 86, 88. The handle 84 is provided with side walls 84a, 84b, which depend downwardly from an upper section 84c of the handle 84. The side walls 84a, 84b may be provided with a plurality of openings 85, if desired. This has the advantage that, even if the side walls 84a, 84b of the handle 84 are quite pronounced, the child can still be seen through the openings 85.

The first pivot mount 86 is pivotally connected to a base end of the first handle side wall 84a and the second pivot mount 88 is pivotally connected to a base end of the second handle side wall 84b so as to allow it to be moved between stowed and carrying positions. When in the stowed position, the handle 84 is generally upright (as shown in Figure 12) so that the handle 84 envelopes the back rest part 76 of the child seat 72. When in the carrying position, the handle 84 is inclined forwards relative to the back rest part 76 (as shown in Figure 13) so that the handle 84 provides a suitable means for carrying the child seat 72 when it is removed from the seat assembly 10 altogether.

When a child is travelling in the child seat 72, the handle 84 is moved into the upright position of Figure 12. In the event of a side vehicle impact (cross-vehicle impact), the handle side walls 84a, 84b provide a lateral support means for the

child's head and thus provide an advantageous safety feature. Optionally, the child seat 72 may also be provided with a movable cover or membrane (not shown in the accompanying figures) in attachment with the handle 84. As the handle 84 is pivoted forwards about the mounts 86, 88, the membrane is drawn forwards to create a part-enclosed volume for a seated child, as indicated by reference numeral 90. Preferably, the membrane is made of a waterproof material.

It is a common problem with known child seat assemblies that once children grow beyond a certain size it is difficult to accommodate them in rear-facing seat positions due to the limited leg space available for their legs. To alleviate this problem, the seat back 12 of the passenger seat may be provided with a movable panel which can be moved when the child seat configuration is adopted to define an opening in the seat back 12. The panel may be removable completely from the seat back 12 or may take the form of a flap which is mounted to a part of the seat back 12 through a suitable hinge arrangement.

The seat assembly may also include a tray (not shown in the accompanying figures) which is received within the internal volume 70 of the seat base 18 so that the child seat assembly 72 locates within the tray when it is mounted upon the support bars 78, 82. The provision of the tray is advantageous as it provides an additional storage vessel for luggage if the child seat 72 is removed from the assembly 10 altogether. The tray may be removable or may be a permanent feature of the seat base 18.

As described previously with reference to Figure 6, if the vehicle is provided with a passenger airbag 56, a means may also be provided for disabling the passenger

airbag of the vehicle in certain circumstances. As before, first and second contacts 48, 50 are electrically co-operable with one another so that when the seat member 26 is lowered into contact with the seat base 18 to define the adult seat configuration, the first and second switch contacts 48, 50 are in electrical connection. The electrical connection between the first and second contacts 48, 50 is broken when the seat member 26 is raised out of the horizontal position, exposing the child seat 72 to allow it to be unfolded within the seat base volume 70. Upon breaking electrical connection between the first and second switch contacts 48, 50, an indication is provided to the airbag control system 52 that the seat member 26 has been raised. The airbag control system 52 then generates a control signal 54 which disables the passenger airbag 56.

If a tilt-type switch arrangement is provided, the airbag control system 52 may be programmed to initiate the 'disable' signal only if both the seat member 26 has been raised beyond a predetermined threshold amount and if it is detected that the child seat 72 has been removed. This avoids inadvertent disabling of the passenger airbag 56 should a severe vehicle impact occur which dislodges the seat member 26.

Although not shown in Figures 12 and 13 for clarity, Figure 14 illustrates a further feature of the child seat 72, namely a harness or restraining means 40 for the child (as in the embodiment of Figure 2). Figure 14 also illustrates how the child seat 72 can be adapted for use as the seat of a push-chair 100. The push-chair 100 includes a seat support frame having a front-side bar 102 with which the ISOFIX mounts 80 of the child seat 72 co-operate when the seat 72 is mounted upon the push-chair 100. The seat back 76 of the child seat 72 rests upon a back support frame 104 of the push-chair 100 and suitable attachment

means (not shown) are provided to secure these parts together. It is therefore a further advantage of the invention that it can be interchanged conveniently between the vehicle and the push-chair 100. If it is not required to carry the child in the child seat 72 itself, the parts 74, 76 can be folded together to form a  
5 portable and compact unit which can be carried conveniently.

## CLAIMS

1. A vehicle seat assembly (110) including;

5

a passenger seat having a passenger seat member (26) and a passenger seat back (12), and

10 a child seat assembly (72) having a seating part (74) and a back rest part (76) and having first and second child seat configurations,

15 wherein the passenger seat member (26) is movable between a first position in which the child seat assembly (72) is substantially hidden from view and a second position in which the child seat assembly (72) is exposed to enable the first child seat configuration to be provided to seat a child passenger.

2. The vehicle seat assembly (110) as claimed in claim 1, wherein the child seat assembly (72) is removably mounted upon the passenger seat.

20 3. The vehicle seat assembly (110) as claimed in claim 1 or claim 2, wherein the seating part (74) is coupled to the back rest part (76) to allow interchange between the first and second child seat configurations through unfolding and folding of said parts (74, 76).

25 4. The vehicle seat assembly (110) as claimed in claim 3, wherein the back rest part (76) of the child seat assembly (172) is coupled to the seating part (74)

through a hinge arrangement.

5. The vehicle seat assembly (110) as claimed in any one of claims 1 to 4, wherein the passenger seat includes a seat base (18) defining an internal volume (70) within which the child seat assembly (72) is accommodated, wherein the seat base (18) is provided with a seat base mount (78) and the child seat assembly (12) is provided with at least one child seat mount (80) for co-operation with said seat base mount (78) to enable mounting of the child seat assembly (72) thereon.
- 10 6. The vehicle seat assembly (110) as claimed in claim 5, including first and second child seat ISOFIX mounts (80) for co-operation with the seat base mount, wherein the seat base mount is a rear-side support bar (78) provided on the seat base (18).
- 15 7. The vehicle seat assembly (110) as claimed in claim 5 or claim 6, wherein the back rest part (76) of the child seat assembly (72) is provided with a releasable mounting means for co-operation with the passenger seat in a removable fashion.
- 20 8. The vehicle seat assembly (110) as claimed in any one of claims 5 to 7, further comprising a tray mounted within the internal volume (70) to provide a storage volume when the child seat assembly (72) is removed from the seat assembly (110).
- 25 9. The vehicle seat assembly (110) as claimed in claim 8, wherein the tray is removably mounted within the internal volume (70) .



10. The vehicle seat assembly (110) as claimed in any one of claims 1 to 9, wherein the passenger seat back (12) is provided with a movable section to define an opening for accommodating a child's legs and/or feet when the child passenger is seated in the child seat assembly (72).

5

11. The vehicle seat assembly (110) as claimed in claim 10, wherein the movable section is removable completely from the passenger seat back (12).

12. The vehicle seat assembly (110) as claimed in any one of claims 1 to 11, including indication means (46, 48, 50) for providing an indication of whether the passenger seat member (26) is in the first or second position.

15

13. The vehicle seat assembly (110) as claimed in claim 12, wherein the indication means includes a switch arrangement (48, 50).

14. The vehicle seat assembly (110) as claimed in claim 13, including a push-type or on-off switch arrangement, wherein a first switch part (50) is mounted on a fixed part (18) of the passenger seat (110) and a second switch part (48) is mounted on the passenger seat member (26).

20

15. The vehicle seat assembly (110) as claimed in claim 14, including a tilt-type switch arrangement.

16. The vehicle seat assembly (110) as claimed in any one of claims 1 to 15, wherein the passenger seat forms a front passenger seat of a vehicle mounted adjacent to a vehicle driver's seat assembly, when in use.

25

17. The vehicle seat assembly (110) as claimed in any one of claims 1 to 16, wherein the child seat assembly includes means (84) for supporting a child's head to prevent unwanted lateral and/or angular movement thereof in the event of a side-vehicle impact.

5

18. The vehicle seat assembly (110) as claimed in claim 17, wherein said supporting means includes a handle (84) of generally horse-shoe form to envelope the seat back part (76) of the child seat assembly (72) when in a handle-stowed position, said handle being movable into a carrying position to enable  
10 convenient carrying of the child seat assembly (72) when it is removed from the seat assembly.

19. A portable child seat assembly (72) forming part of a vehicle seat assembly (110) as claimed in any one of claims 1 to 18.

15

20. The portable child seat assembly (72) as claimed in claim 19, including a handle (84) which is movable between a stowed position and a carrying position.

21. The portable child seat assembly (72) as claimed in claim 20, wherein the  
20 handle (84) is coupled with a membrane which is movable with the handle (84) so as to provide at least a partial cover for the child passenger when seated within the child seat assembly (72).

22. A portable child seat assembly (72) for interchangeable mounting within  
25 (i) a vehicle seat assembly (110) as claimed in any one of claims 1 to 18 or (ii) a push-chair frame (100), wherein the child seat assembly (72) includes at least one ISOFIX mount (80) for co-operation with ISOFIX-compatible supports (78,102)

provided on the vehicle seat assembly (110) and/or push-chair frame (100).

23. A push-chair (100) including a push-chair frame and a child seat assembly (72) as claimed in claim 22, wherein the push-chair (100) includes the ISOFIX-compatible support (102) for co-operation with the ISOFIX mount (80) of the  
5 child seat assembly (72).

24. A vehicle having a front passenger seat assembly (110) and an airbag (56) provided on the front passenger side of the vehicle, wherein the front passenger  
10 seat assembly (110) is as claimed in any one of claims 12 to 18, the vehicle further comprising means (46, 52, 54) for automatically disabling the passenger airbag (56) in the event that said indication means provides an indication that the passenger seat member (26) is in the second seat position.

15 25. A vehicle seat assembly (10) providing first and second seat positions for a passenger and including;

a first seat member (26) and a seat back (12) defining a first seat surface (28) and a first back rest surface (14), respectively, for the passenger when in the first seat  
20 position, and

a second seat member (18) defining a second seat surface (20) for the passenger when in the second seat position, wherein the first seat member (26) is movable relative to the second seat member (18) to define a second back rest surface (30)  
25 for the passenger when in the second seat position.

26. The seat assembly (10) as claimed in claim 25, wherein the first seat member is a dual-sided seat member (26) having a first side defining the first seat surface (28) and an opposing side defining the second back rest surface (30).

5 27. The seat assembly (10) as claimed in claim 26, including pivot means for permitting the first seat member (26) to pivot relative to the second seat member (18) so as to permit the seat assembly (10) to be moved between the first and the second seat positions.

10 28. The seat assembly (10) as claimed in claim 27, wherein the pivot means includes a hinged arrangement.

29. The seat assembly (10) as claimed in claim 25, wherein the first seat member (26) is translatable relative to the second seat member (18).

15

30. The seat assembly (10) as claimed in claim 29, wherein the first seat surface and the second back rest surface are defined by the same surface of the first seat member (26).

20 31. The seat assembly (10) as claimed in any one of claims 25 to 30, including indication means (46, 48, 50) for providing an indication of whether the seat assembly (10) is in the first or the second seat position.

25 32. The seat assembly (10) as claimed in claim 31, wherein the indication means includes a switch arrangement (46, 48, 50).

33. The seat assembly (10) as claimed in claim 32, wherein the switch

arrangement is a latch arrangement including a first latch member (48) mounted on the first seat member (26) and co-operable with a second latch member (50) mounted on the second seat member (18) whereby the first latch member (48) engages or otherwise co-operates with the second latch member (50) when the seat assembly (10) provides the first seat position the latch members (48, 50) are caused to disengage when the seat assembly (10) provides the second seat position.

34. The seat assembly (10) as claimed in claim 33, wherein the latch arrangement is an electrical latch means (46, 48, 50), configured such that when the first seat member (26) is inclined relative to the second seat member (18) to define the second seat position an electrical connection is broken, said electrical connection being re-established when the first seat position is adopted and said first and second latch members (48, 50) are caused to engage or otherwise co-operate.

35. The seat assembly (10) as claimed in any one of claims 25 to 34, wherein the first seat member (26) forms a part of a front seat assembly (10) of a vehicle for mounting adjacent to a vehicle driver's seat assembly, in use.

20

36. The seat assembly (10) as claimed in any one of claims 25 to 35, wherein the first seat position is that adopted for an adult passenger, and the second seat position is that adopted for a child passenger so that the seat assembly (10) has an integrated child seat in which the second seat surface (20) defines a child seating surface and the second back rest surface (30) defines a child back rest surface.

25

37. The seat assembly (10) as claimed in any one of claims 25 to 36, wherein the seat back (12) is arranged to be moveable between a generally upright position and a reclined position, whereby when in the reclined position the seat assembly (10) provides the second seat position for the passenger and the first  
5 back rest surface (14) defines a support surface for the passenger's legs.

38. The seat assembly (10) as claimed in claim 37, wherein the seat back (12) includes additional pivot means (36) for permitting pivotal movement of the seat back (12) relative to the first seat member (26) so as to permit the first seat back  
10 surface (14) to move into the reclined position.

39. The seat assembly (10) as claimed in claim 38, wherein the seat back (12) is foldable and/or collapsible.

15 40. The seat assembly (10) as claimed in any one of claims 25 to 39, wherein the second seat surface (30) is hidden from view when the seat assembly provides the first seat position.

41. The seat assembly (10) as claimed in claim 40, wherein the second seat  
20 member is a base (18) of the seat assembly (10).

42. The seat assembly (10) as claimed in any one of claims 25 to 41, further comprising harness means (38, 40) for harnessing the child passenger in the second seat position.



43. The seat assembly (10) as claimed in any one of claims 25 to 42, further comprising adjustment means (36) for adjusting the angle of inclination of at least one of the first and second back rest surfaces (14, 30).

5 44. A vehicle having a passenger's seat assembly (10) and a passenger airbag (56) provided on a passenger side of the vehicle, wherein the passenger's seat assembly (10) is as claimed in any one of claims 31 to 43, the vehicle further comprising means (52) for automatically disabling the passenger airbag (56) in the event that the indication means (46, 48, 50) provides an indication that the  
10 second seat position is provided.

**ABSTRACT****VEHICLE SEAT ASSEMBLY**

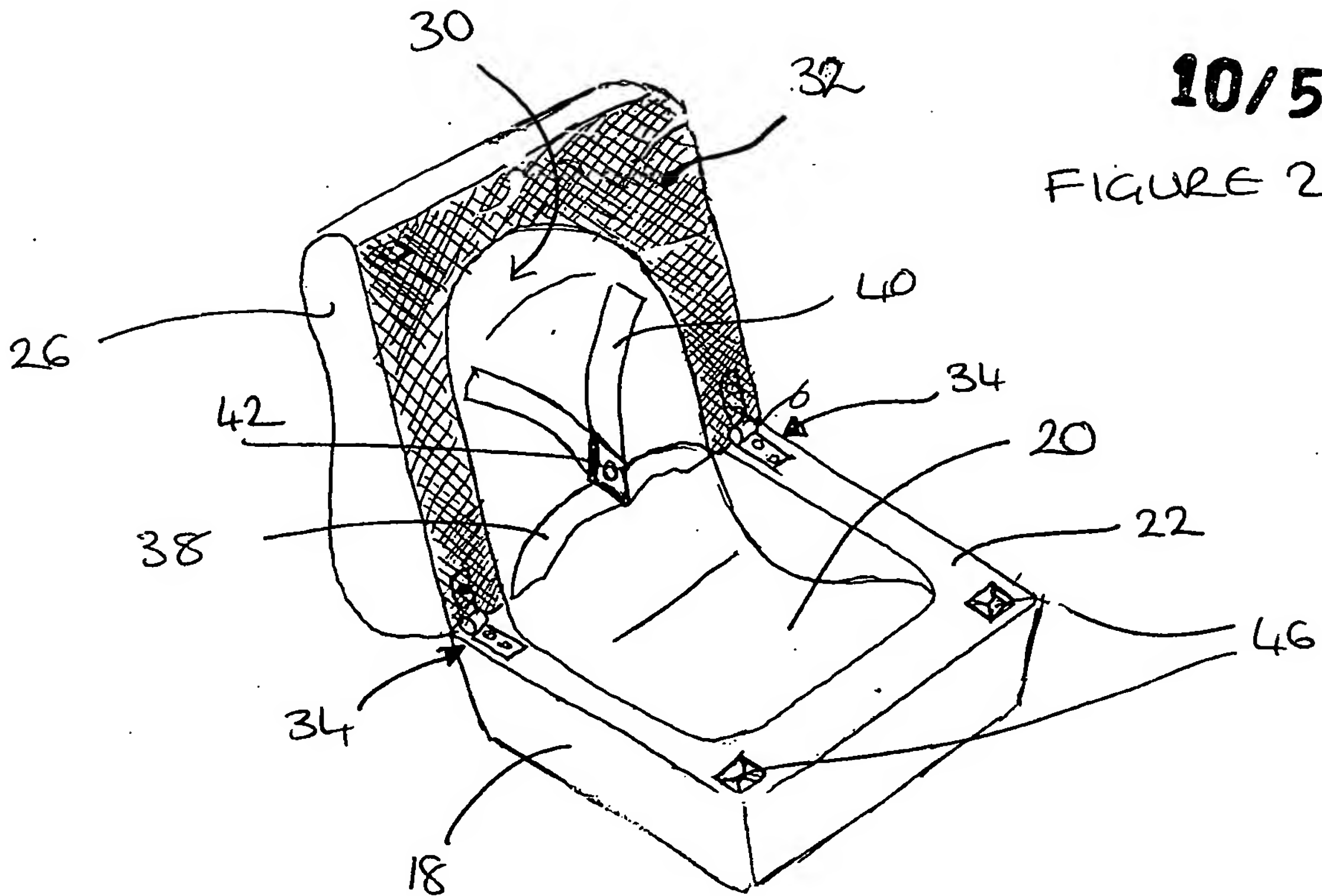
5 A vehicle seat assembly (10; 110) includes a passenger seat having a passenger seat member (26) and a passenger seat back (12), and a child seat assembly (72) having a seating part (74) and a back rest part (76). The child seat assembly 72 provides first and second alternative child seat configurations. In one embodiment, the seat assembly (110) includes a passenger seat member (26)  
10 which is movable between a first position in which the child seat assembly (72) is substantially hidden from view and a second position in which the child seat assembly (72) is exposed to enable the first child seat configuration to be unfolded to seat a child passenger. The child seat assembly (72) may be mounted so that it can be removed completely from the assembly (110). In another  
15 embodiment, the passenger seat member (26) is movable between a first position in which a seating surface is defined for an adult passenger, and a second position in which, for example, a reverse side of the seat member (26) defines a back rest surface for a child passenger.

20 [Figure 1]

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FIGURE 2



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FIGURE 4

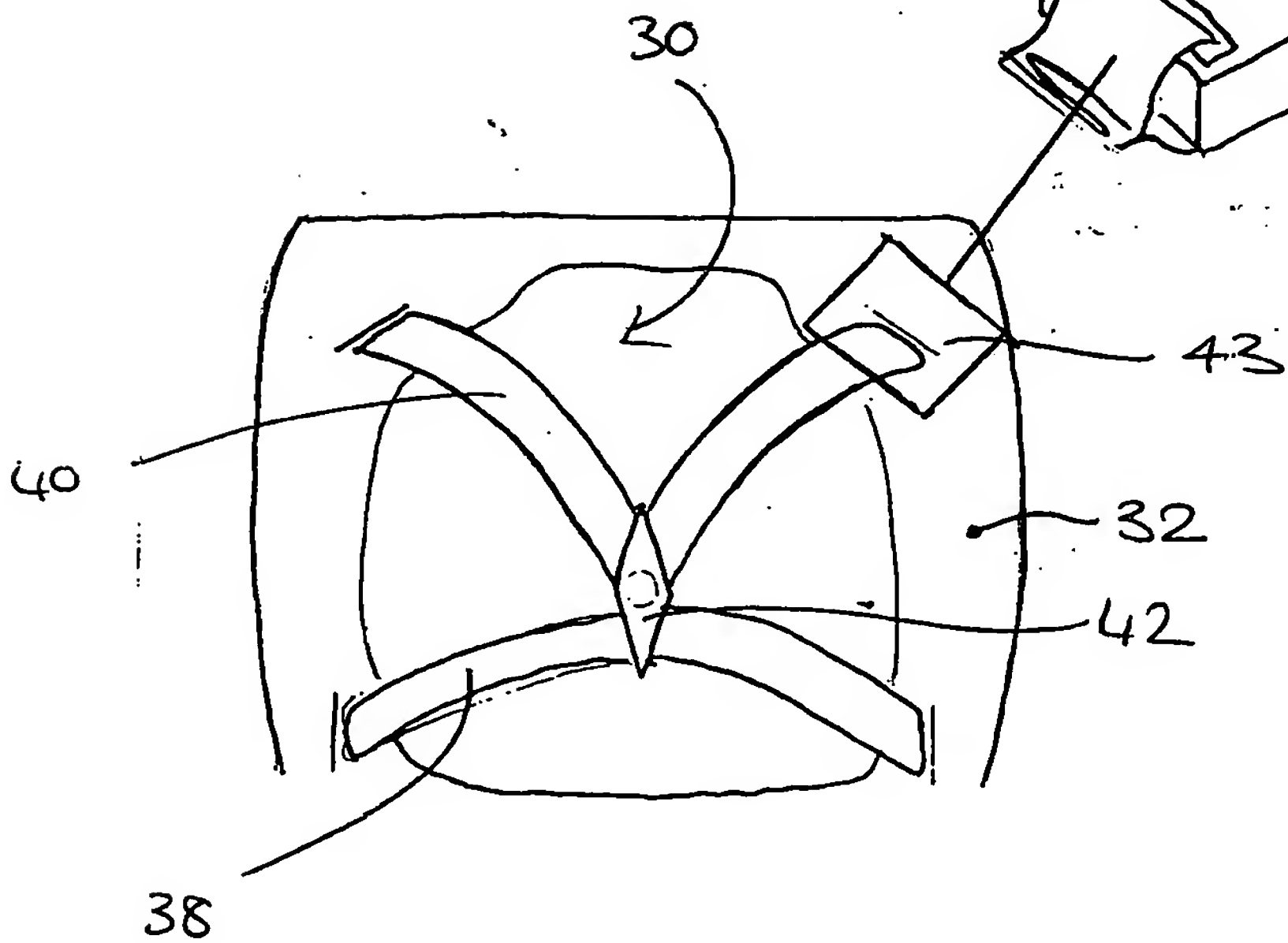
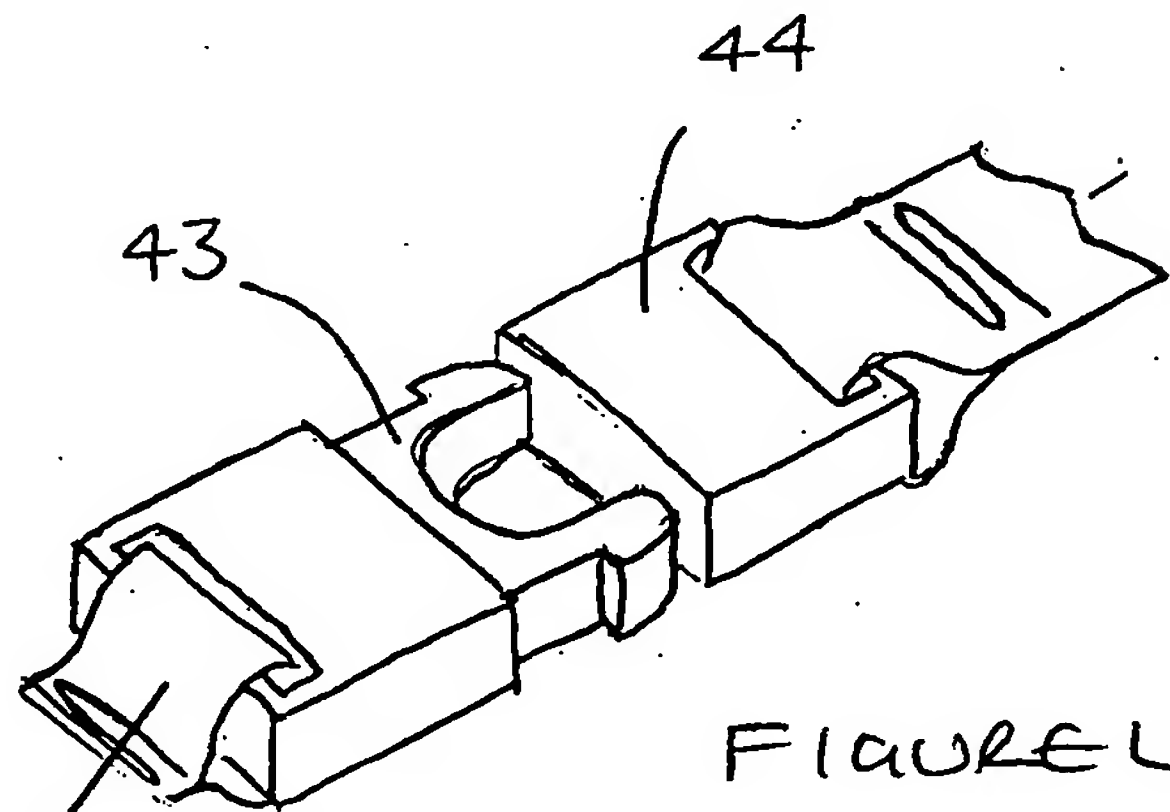


FIGURE 3

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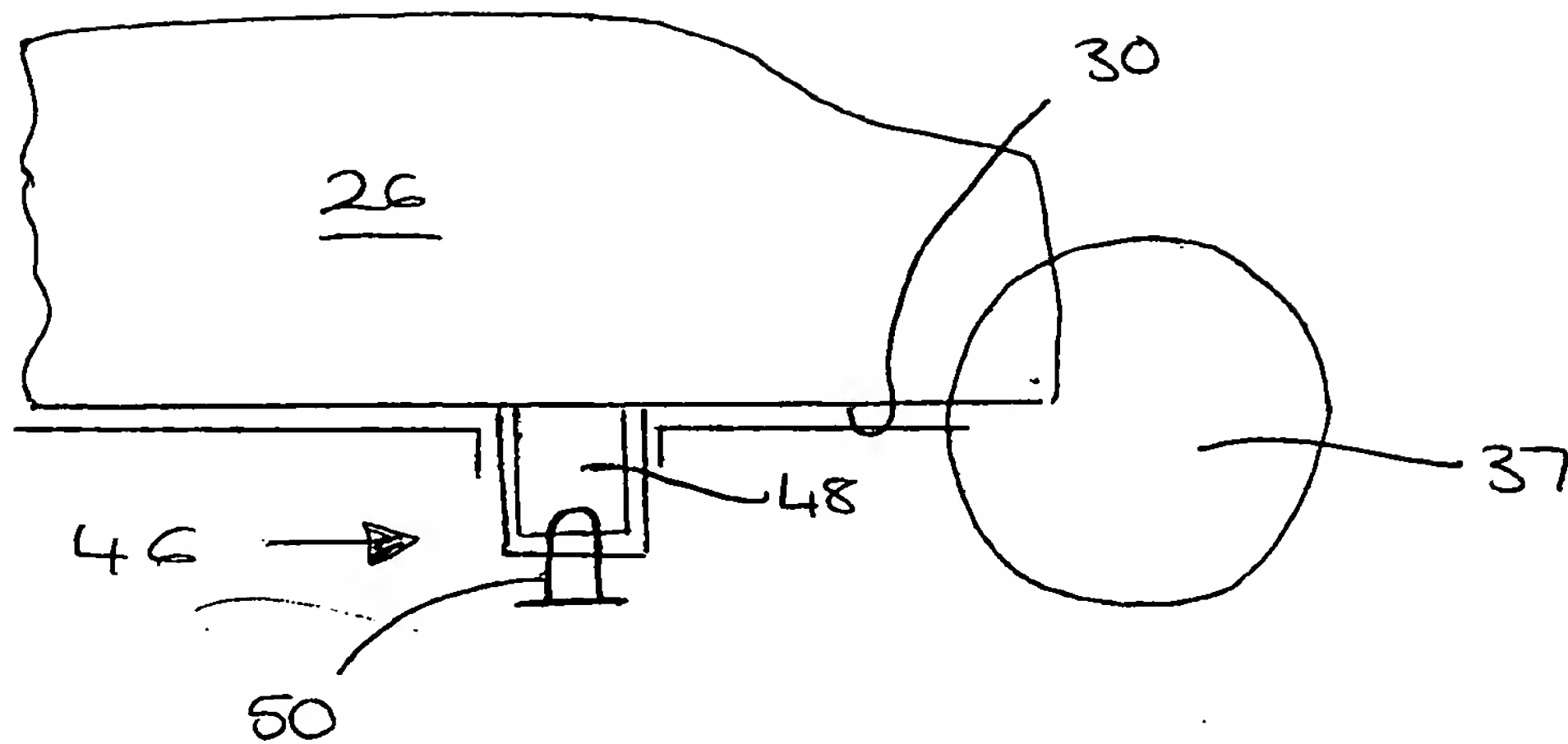


FIGURE 5

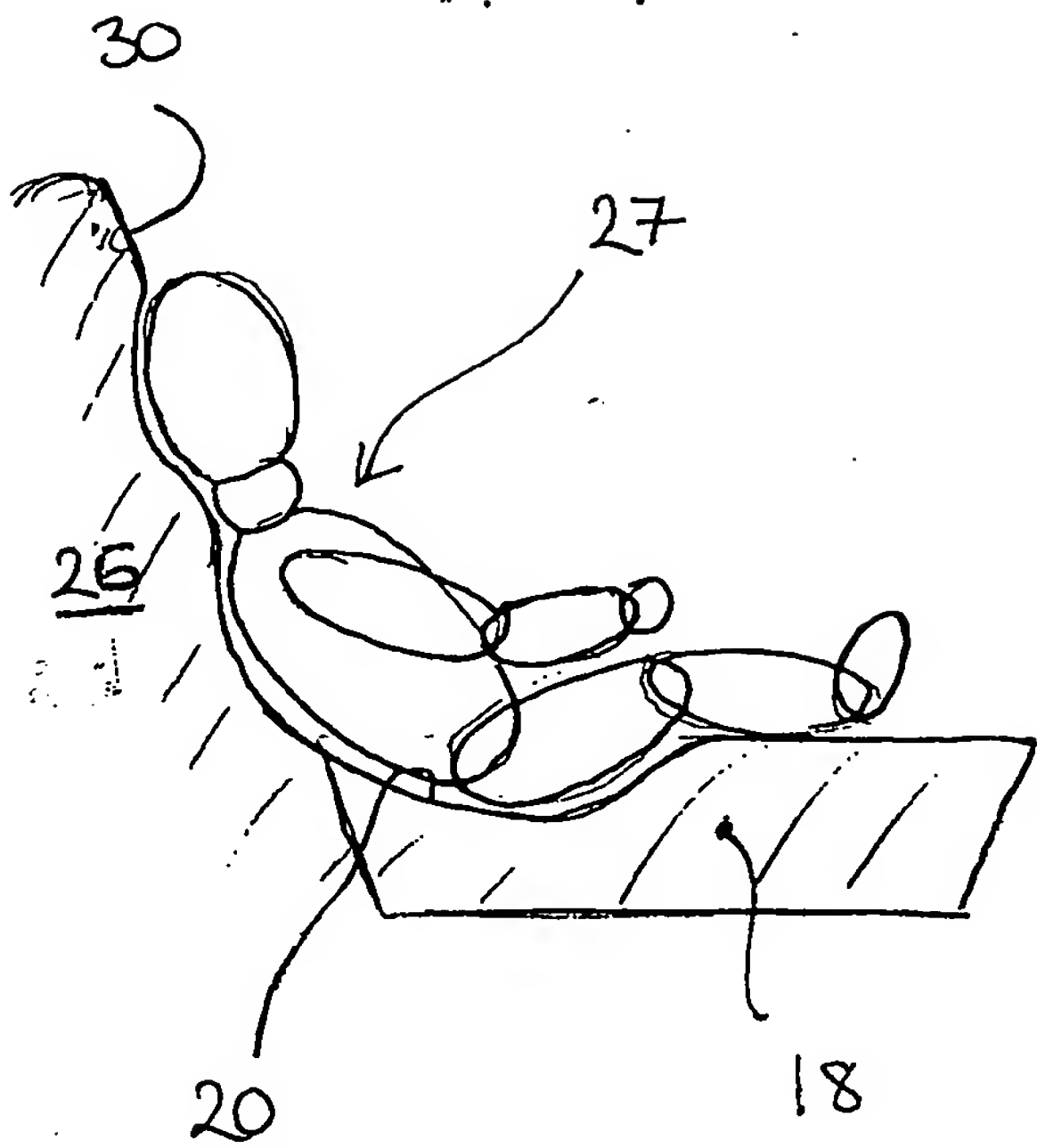
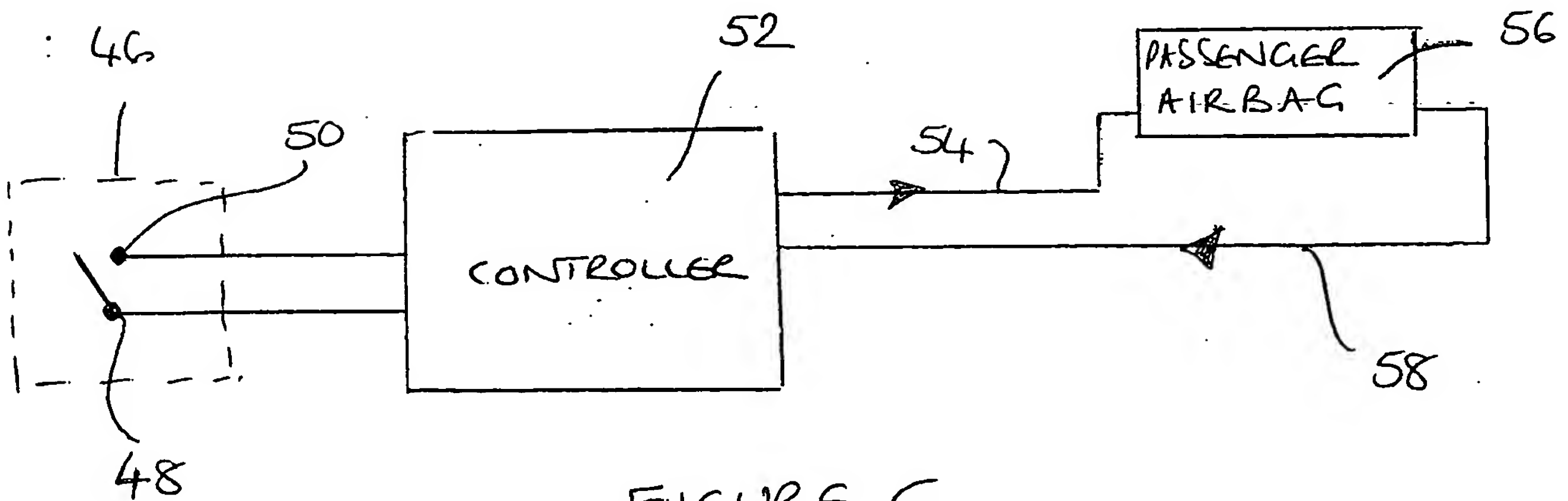
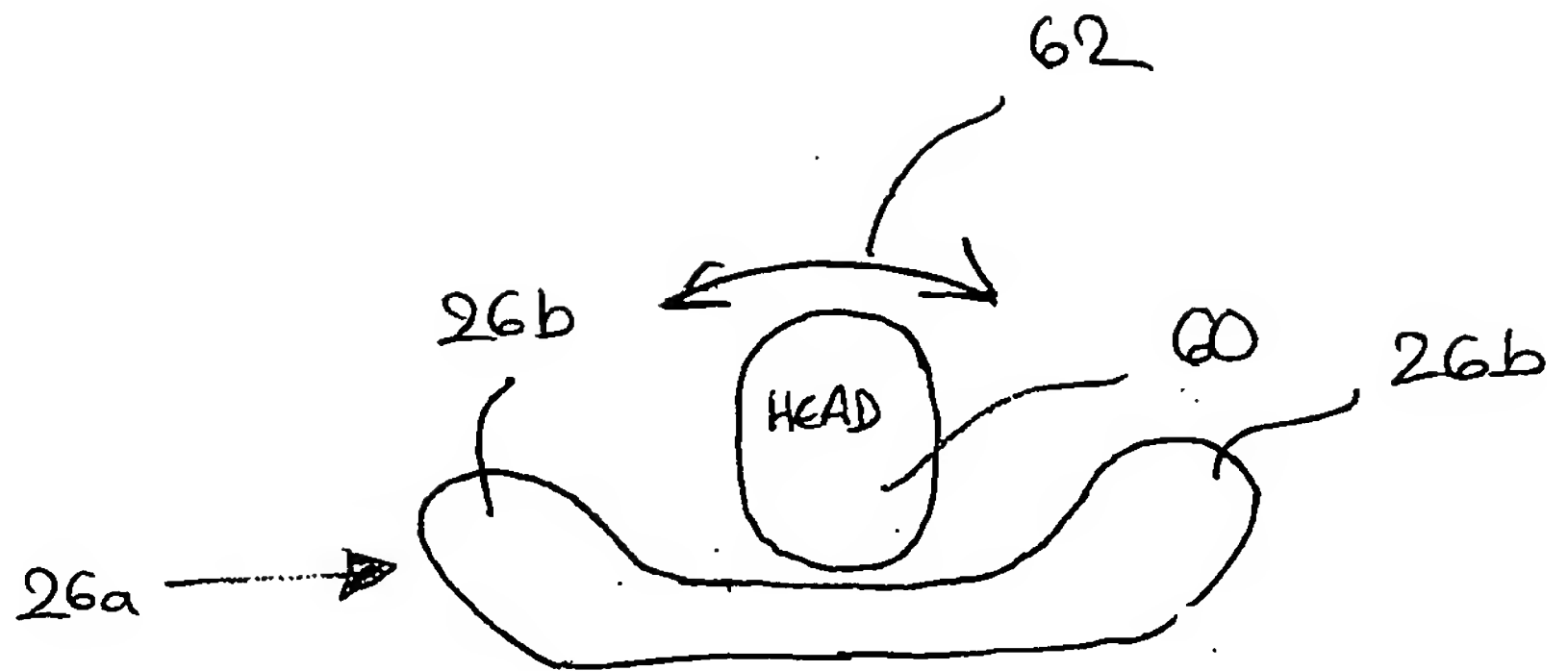
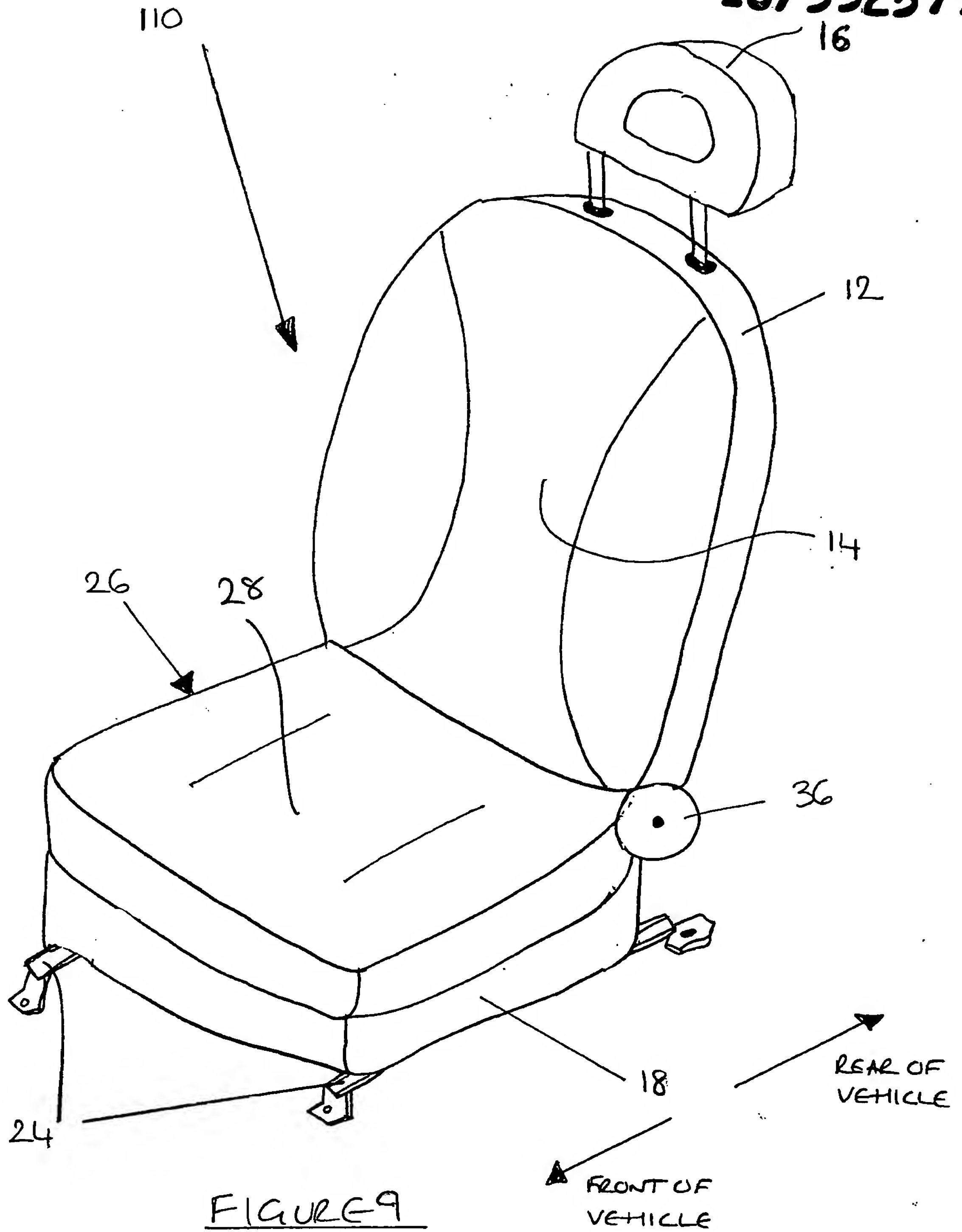


FIGURE 8







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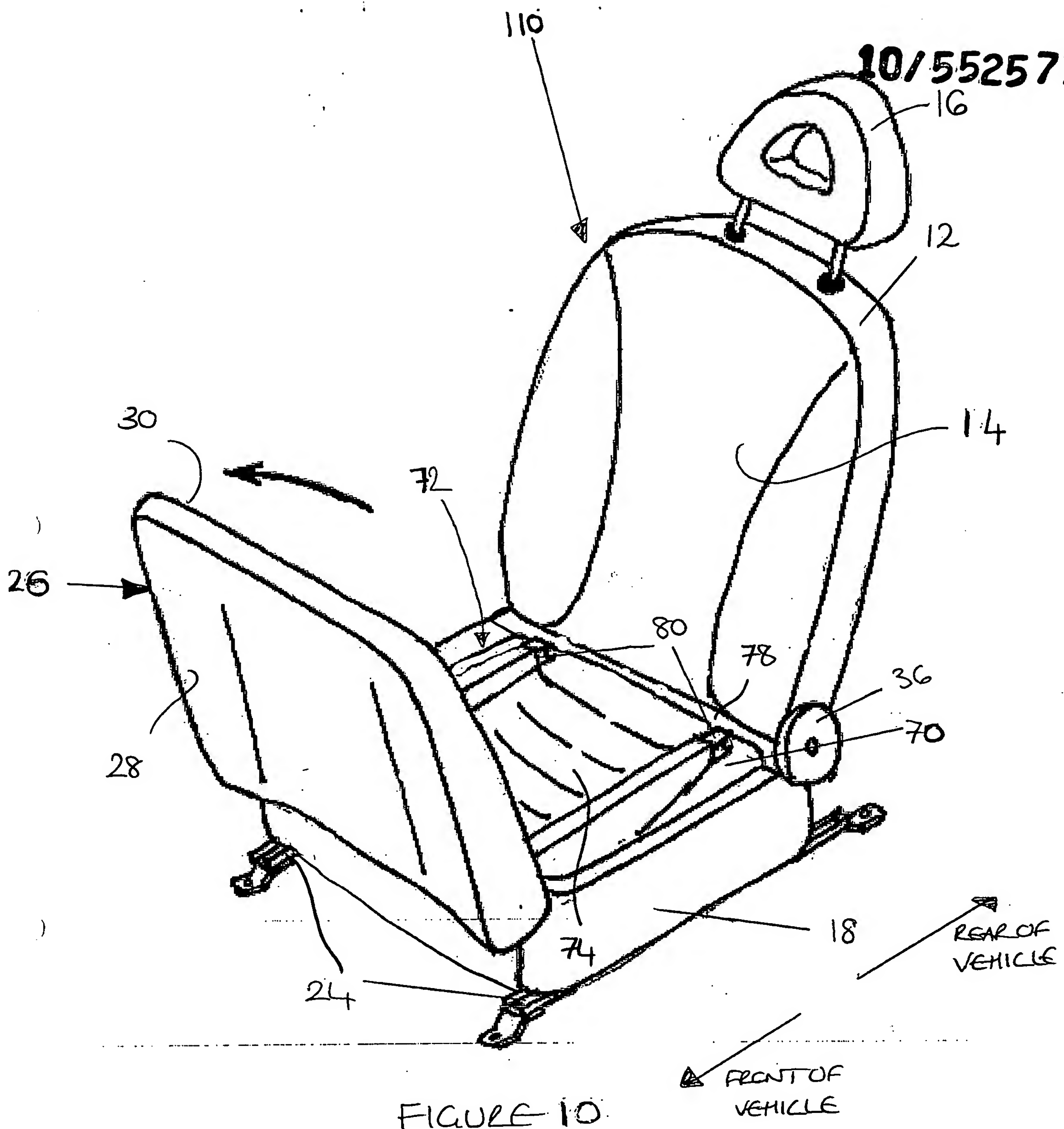


FIGURE 10

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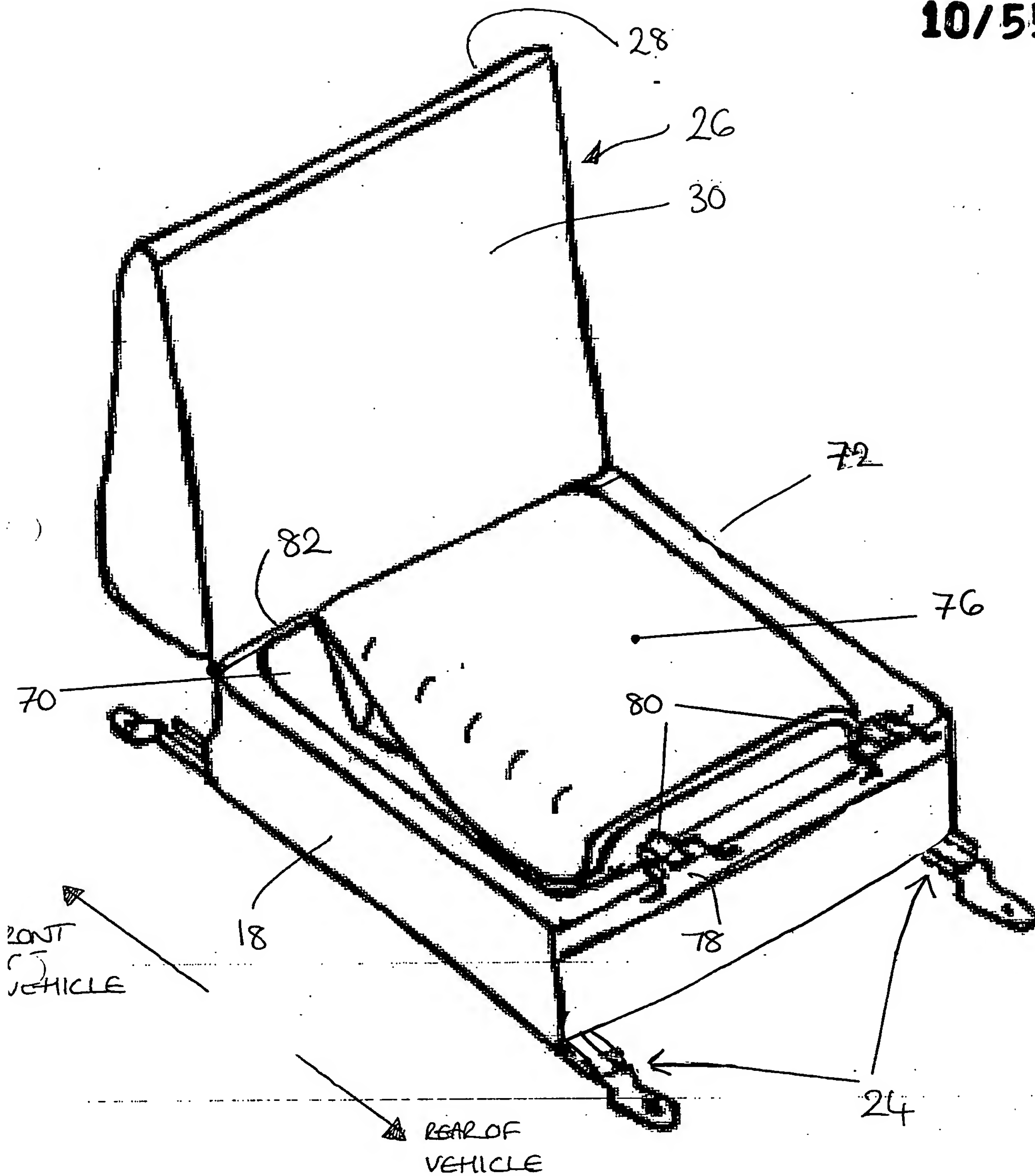


FIGURE 11

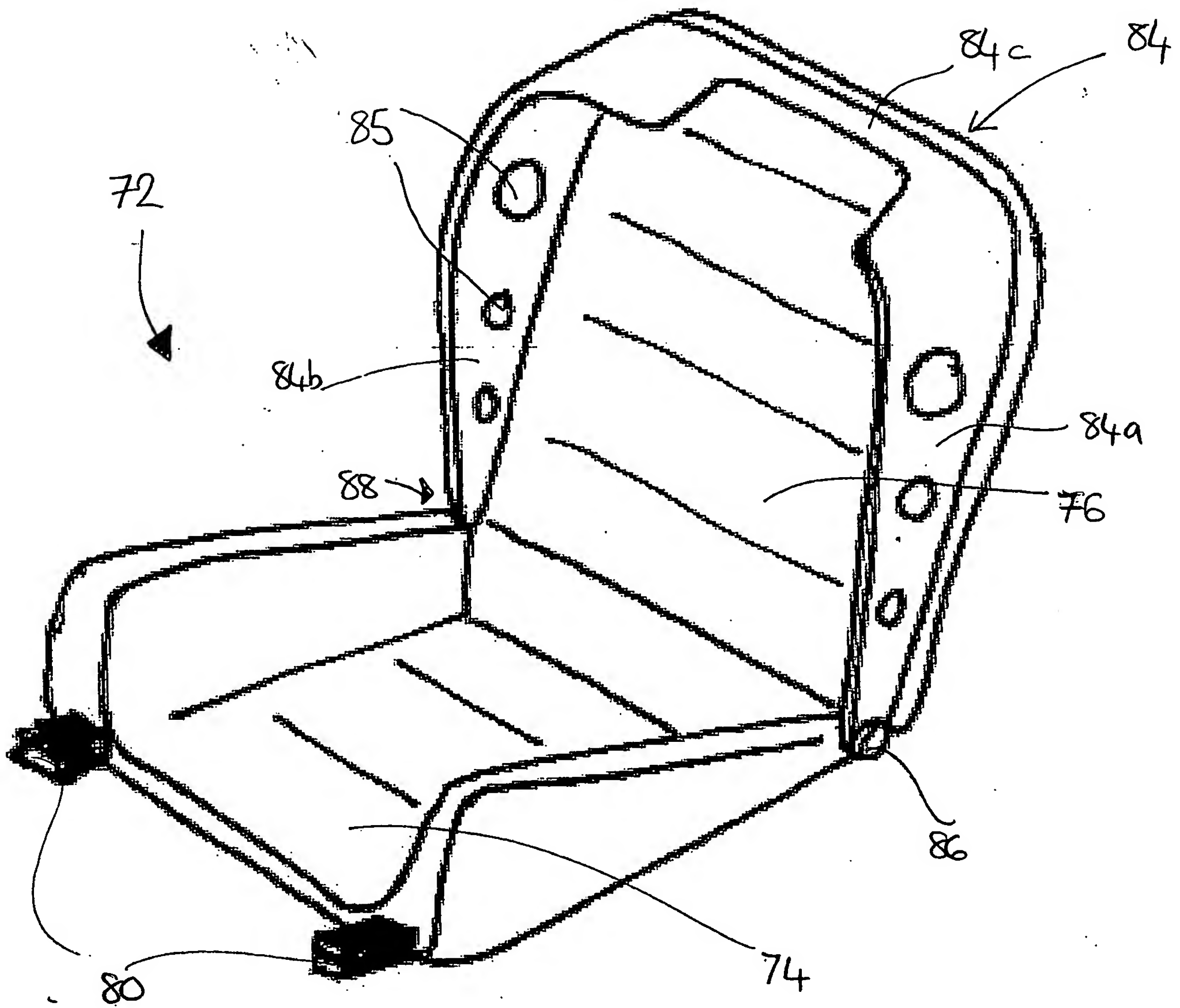


FIGURE 12

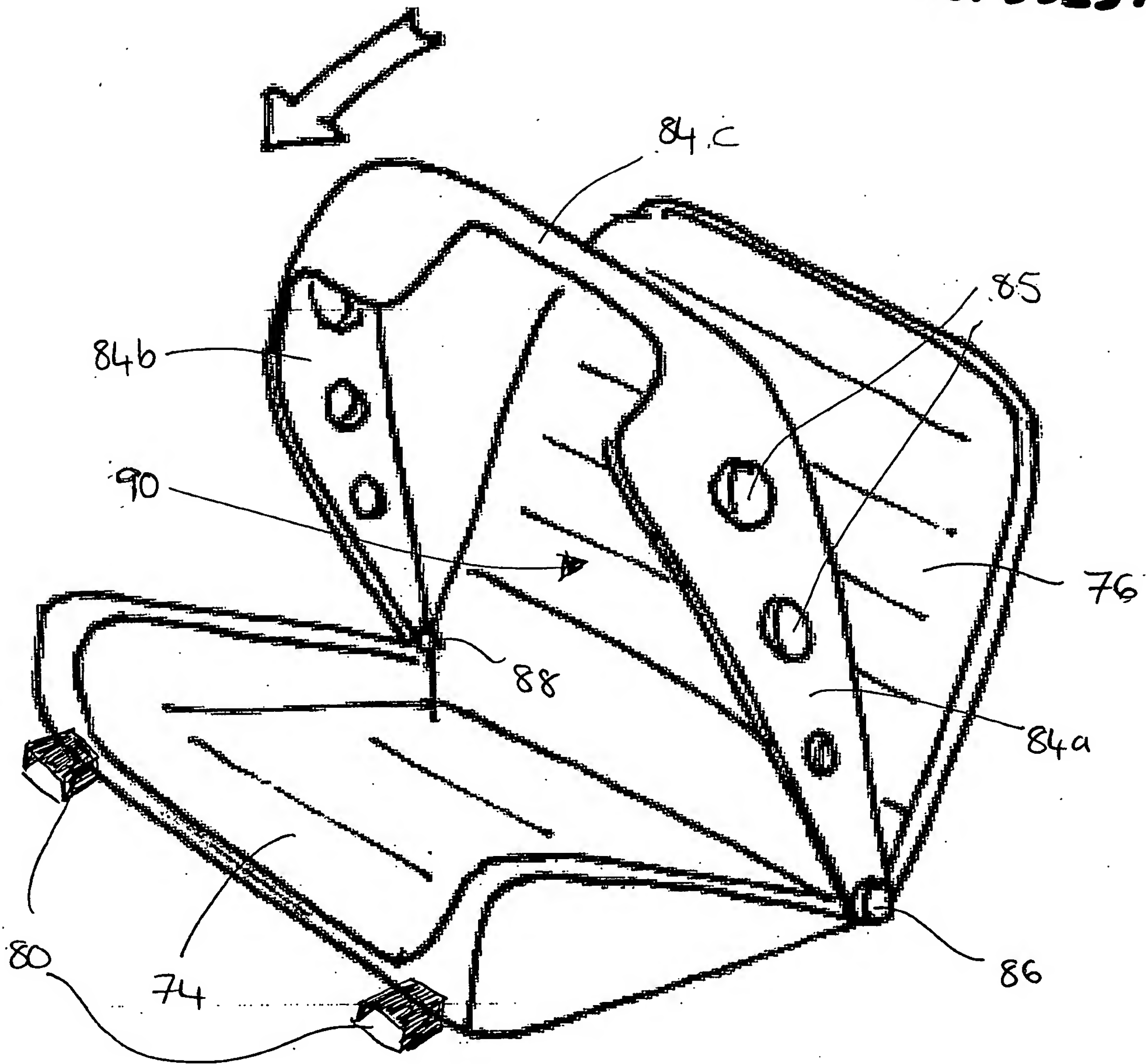


FIGURE 13

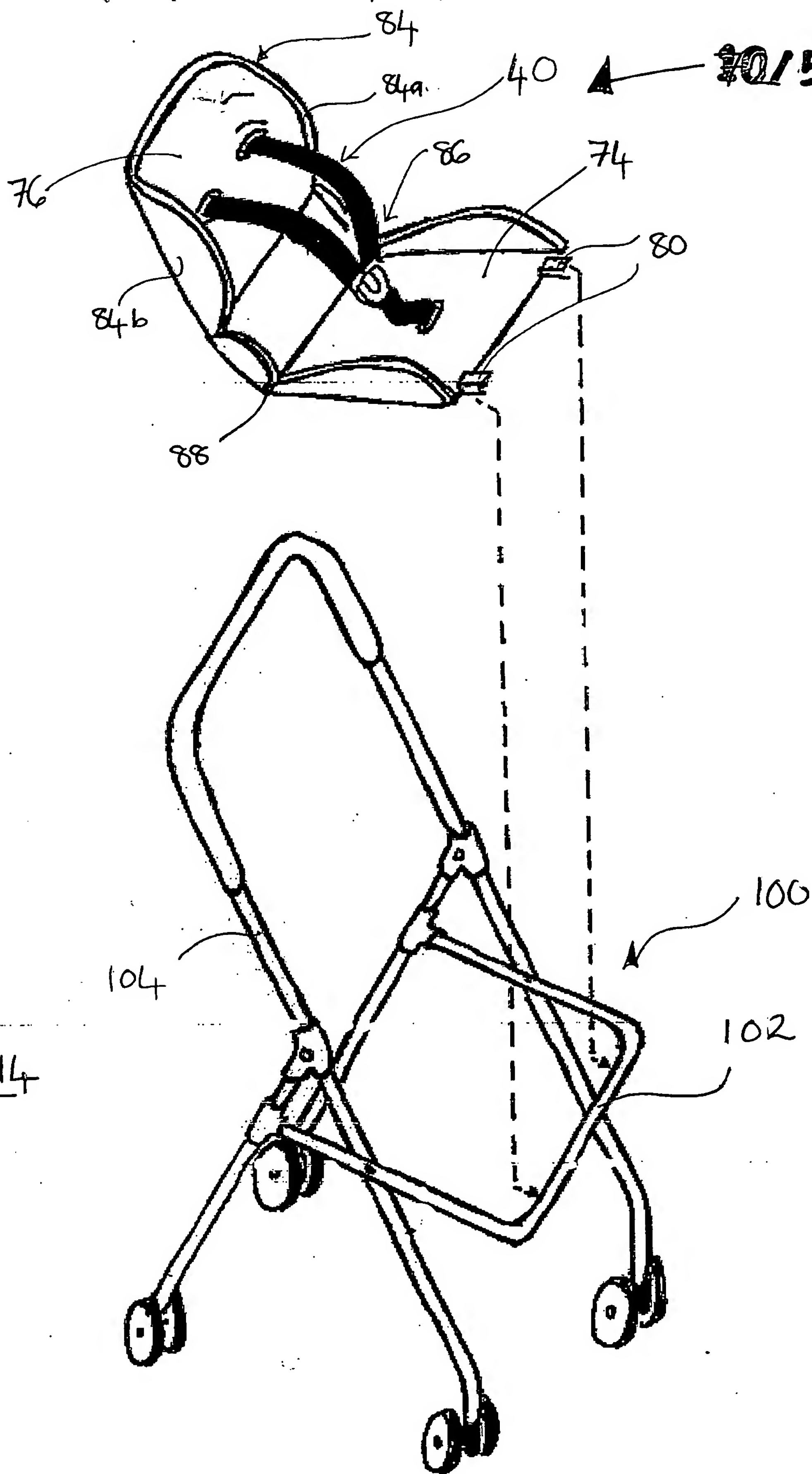


FIGURE 14